UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/810,932	03/16/2001	Keith R. Jones	MNDSPD.0005P	7235

7590 06/16/2003

Weide & Associates, Ltd.
11th Floor, Suite 1130
330 South 3rd Street
Las Vegas, NV 89101

EXAMINER	
WEST, JEFFREY R	
ART UNIT	**PAPER NUMBER**
2857	

DATE MAILED: 06/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/810,932	Applicant(s) JONES ET AL.
	Examiner Jeffrey R. West	Art Unit 2857

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period f r Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *31 March 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-70* is/are pending in the application.

4a) Of the above claim(s) *14-20, 31-39, and 55-59* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13,21-30,40-54 and 60-70* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 March 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Pri rity under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:

The description on page 25, lines 17-19 is confusing because the multipliers are referenced by both reference characters and setting values. The amended specification still refers to "a multiplier 514B C_{N-1}" and "a multiplier 514C that has a multiplier C_N." It is suggested that "connecting to a delay register 510C and to a multiplier 514B C_{N-1}. The output of delay register 510C connects to a multiplier 514C that has a multiplier C_N" be changed to match the language of the description on page 25, line 16, as --- connecting to a delay register 510C and to a multiplier 514B, set to C_{N-1}. The output of delay register 510C connects to a multiplier 514C, set to C_N---.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-5, 7, 8, 11-12, 26, 27, 40, 41, 43, 60-62, 64-67, 69, and 70 are rejected

under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,298,118 to Liggett in view of U.S. Patent No. 6,534,996 to Amrany et al. and U.S. Patent No. 5,600,248 to Westrom et al.

Liggett teaches a method for testing a twisted pair communication channel using time domain reflectometry (column 4, lines 11-16) comprising a pseudo-random code processor that generates and decodes pseudo-random coded signals to be transmitted on, and received from, the twisted pair conductor channel (column 4, lines 64-67), such as an asymmetric digital subscriber line (column 3, lines 48-49) connected to a computer modem for communication on the channel (column 3, lines 33-34), wherein the signals are sent at a low energy (i.e. power) level to lower the possibility of cross-talk occurring across the various twisted line channels (column 5, lines 9-12). Liggett also teaches that the transmitted signals (i.e. test signals) are generated using a code generator that reads from a shift register memory to define a specified maximal length sequence code, with corresponding taps, (column 5, lines 13-18 and 25-30) which is transmitted over the communication channel and reflected back, in response to the transmission, to the receiver for sending to a cross-correlator (column 5, lines 18-24), inherently with processing code, which correlates the original maximal length sequence signal with the reflected signal (column 5, lines 51-55). Liggett also teaches that a peak detector detects a plurality of peaks (i.e. signal components) of the reflected signal including peaks in response to an unwanted near-end echo pulse at the start of the signal, caused by reflection at the

line interface, and a bridged tap in the communication channel (column 7, lines 30-37).

With respect to claim 26, it is considered inherent that the input test signal of Liggett has some type of auto-correlation property because, as shown by the definition of auto-correlation, any signal that can be integrated has some auto-correlation property. Also, while the invention of Liggett doesn't specifically mention detecting the presence of impedance mismatches, it is considered well-known in the art that the bridge taps disclosed by Liggett are actually impedance mismatches (see U.S. Patent Application Publication No. 2002/0114383-A1 to Belge et al., 0073 and 0076).

Liggett, however, teaches implementing the method using a remote device, rather than using an existing modem, and does not teach a method for removing the unwanted near-end echo or a method for measuring the location of the fault in the communication line.

Amrany teaches a system and method for phone line characterization by time domain reflectometry comprising a method for transmitting and receiving reflection signals sent using components and processor code existing in a DSL modem (i.e. processor components, transmitting components, receiving components, and signal generating components that are configured to operate as part of the DSL during normal communication) connected to a communication channel (column 1, lines 51-67, column 6, lines 19-29, and Figure 5). Amrany teaches that the reflected signal is analyzed to determine the type and location of impedance disruptions (column 3,

lines 20-41) of the twisted pair transmission line (column 3, lines 48-50). Amrany also teaches including an echo canceller (column 4, line 63), a finite impulse response filter (column 5, lies 4-6), and a de-convolution means, with processing functions similar to that of the correlation means of Liggett, to detect phase differences and corresponding coefficients in determining the line abnormalities (column 9, lines 9-57). Amrany also teaches that the transmitted signal is a highly sampled plurality of pulses (column 8, lines 33-53).

Westrom teaches a fault distance locator for underground cable circuits comprising generating a pulse into a communication channel to obtain a reference pulse signal (i.e. template), during a setup operation, (column 4, lines 62-65) and, during actual operation, receiving a plurality of reflected pulses (column 8, lines 41-51) including an unwanted near-end echo pulse, caused by the reflection at the line interface, which is removed by subtracting the obtained reference/template pulse data from the actual received pulse data set (column 9, lines 9-21). Westrom then teaches determining a time interval between the beginning of the pulse injection and the subsequent peak/pulse (i.e. point of correlation) indicative of a line abnormality and then multiplying the time interval times the propagation speed to determine the distance to the location of the fault (column 9, lines 56-64). Westrom also teaches a computer controller comprising a microprocessor and a corresponding memory for storing a program, executed by the microprocessor, that initiates the generation of the input pulses, calculates the time interval to the fault (column 8, lines 14-21), and also connects to a modem to report monitoring information (column 6, lines 40-45).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett to include using an existing modem for carrying out the time-domain reflectometry method, as taught by Amrany, because, as suggested by Amrany, the combination would have reduced costs by using existing circuitry rather than requiring separate circuitry and eliminated the need for test equipment that may introduce disturbance effects (column 1, lines 40-47 and column 6, lines 19-29).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett to include a method for removing the unwanted near-end echo and a method for measuring the location of the fault in the communication line, as taught by Westrom, since Liggett teaches that the near-end echo pulse is undesired and not used in measurements and Westrom provides a corresponding method to insure that the accuracy of the measurement is maintained by removing the unwanted pulse (i.e. the calculations will be based on full reflected pulses at the occurrence of a fault rather than the first extraneous pulse) and, as suggested by Westrom, the combination would have allowed quick repair or replacement of a transmission line fault by providing an exact location of the problem (column 1, lines 22-27).

Although the invention of Liggett and Westrom doesn't specifically disclose aligning the template signal and the correlated signal to determine a point of alignment, it is considered inherent that in order for the template signal to be subtracted from the correlated signal to correctly remove the near-end echo pulse, the signals must first be properly aligned.

With respect to claim 2, Liggett teaches correlating the generated sequence and the reflected sequence to generate a correlated signal for processing. Westrom teaches obtaining a template signal by sending actual pulses, consistent with actual implementation, to obtain the near-end signal created by the line interface. Therefore the combination of the inventions of Liggett and Westrom would have provided a template signal as a correlated version of a reflection created by a line interface. Similarly, with respect to claim 27, since the invention of Westrom and Liggett teaches determining a time difference between the start of the signal, corresponding to the point where the line interface causes a near-end echo, and a subsequent peak, the invention also teaches determining a time difference between the receipt of the near-end echo and a subsequent peak.

Further, with respect to claim 70, the invention of Liggett, Amrany, and Westrom teaches a computer, and associated programs/code, for generating a sequence signal, as well as initiating transmission of a sequence signal over a communication channel, receiving a reflection caused by the sequence signal, and correlating the reflection signal and the generated sequence to form a correlated signal. Based on this teaching it considered inherent that a modified generated sequence would undergo the same method and be included the modified result with the initial, unmodified result, because the modified sequence would be sent through the same devices, with the same functions, in continuation with the initial signal sent.

4. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett

in view of Amrany and Westrom and further in view of U.S. Patent Application Publication No. 2002/0114383-A1 to Belge et al.

As noted above, the invention of Liggett, Amrany, and Westrom teaches all the features of the claimed invention except for specifying that the processing of the reflected sequence be used to determine the location an impedance mismatch corresponding to a load coil.

Belge teaches systems and methods for characterizing transmission lines using broadband signals in a multi-carrier DSL environment including performing time domain reflectometry by sending a signal over the DLS channel and analyzing the reflected echo to determine any impedance discontinuity (i.e. mismatch) caused by bridged taps, an open-end of the loop, load coils, or the like (0073 and 0076).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, and Westrom to include specifying that the processing of the reflected sequence be used to determine the location an impedance mismatch caused by a load coil because the combination would have allowed for the invention to detect and process the location of a wider variety of faults occurring on a DSL line.

5. Claims 6, 13, 30, and 63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Amrany and Westrom et al. and further in view of U.S. Patent No. 5,062,703 to Wong et al.

As noted above, the invention of Liggett, Amrany, and Westrom teaches all of the features of the claimed invention except for adding a rotated reflection signal to the correlated signal to reduce or remove artifacts on the correlated signal.

Wong teaches a method and apparatus for measuring the length of, or distance to discontinuities in, an optical transmission medium using optical time domain reflectometry by generating a pulse and transmitting the pulse through the optical line until a discontinuity is encountered wherein a portion of the pulse is reflected back to the measurement system (column 1, lines 37-51). Wong also teaches that by combing the reflected signal with an amplitude ripple generated due to the rotation of the incident and reflected optical signals (column 9, lines 21-50) the result can then be used to mathematically remove undesirable reflection (i.e. artifacts) from the desired response by gating components of the ripple pattern generated as the result of the rotation (column 11, lines 1-6).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, and Westrom to include adding a rotated reflection signal to the correlated signal to reduce or remove artifacts on the correlated signal, as taught by Wong, because, as suggested by Wong, the combination would have provided a method for removing undesired artifacts and computing the propagation delay, as well as provided a method for determining multiple events attributable to different discontinuities in the channel (column 2, lines 46-54 and column 3, lines 3-12).

6. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Amrany and Westrom and further in view of U.S. Patent No. 4,963,020 to Luthra et al.

As noted above, Liggett in combination with Amrany, Westrom, and Belge teaches all the features of the claimed invention except for determining the location of a line anomaly by processing coefficients of a prediction filter.

Luthra teaches a method for detecting splices in an optical fiber using a time domain reflectometer that transmits a light pulse into an optical fiber and receives a reflected signal, which is stored in a memory, (column 2, lines 8-15) and also passed to a linear prediction filter (column 2, lines 29-38) (i.e. a finite impulse response filter) (column 2, lines 55-57), that has weights, corresponding to its coefficients (column 3, lines 50-54), which are used for determining a future signal to predict the splice (i.e. line anomaly) (column 2, line 67 to column 3, line 10). Luthra also teaches that the correlation filter be used to detect a splice by comparing the output of the correlation filter with a threshold (column 5, lines 19-26).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, and Westrom to include determining the location of a line anomaly by processing coefficients of a prediction filter, as taught by Luthra, because, as suggested by Luthra, the combination would have removed decaying exponential portions of the reflected signal to provide only the desired information pertaining to line anomalies (column 2, lines 29-38).

7. Claims 21, 22, 25, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Amrany and Westrom, and further in view of U.S. Patent No. 4,597,183 to Broding.

As noted above, Liggett in combination with Amrany and Westrom teaches many of the features of the claimed invention including calculating the distance to an impedance mismatch using a time interval and propagation rate, but does not teach multiplying a time interval from the start of reflection to the occurrence of a signal component, indicating a fault, by one-half the rate of propagation of the reflection through the communication channel to determine the distance between one end of the communication channel and the impedance mismatch. The combination also doesn't teach specifying that the test signal have good autocorrelation properties

Broding teaches a method and apparatus for measuring a length of a cable using time domain reflectometry by transmitting a pulse sequence, in the form of an autocorrelation function (i.e. has good autocorrelation properties), over the communication channel (column 10, lines 35-41) and, upon the detection of its reflection, calculating the length of the round trip of the signal through the cable by multiplying a time interval between the generation of the sequence and a signal component indicating the reflection by the velocity of propagation. Broding also teaches the equivalent method for determining only the length of the cable during the initial trip by multiplying a time interval between the generation of the sequence and the signal component indicating reflection, or equivalently the time interval

between the signal component indicating reflection and the initial generation of the sequence, by one-half and the velocity of propagation (column 2, lines 48-61).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, and Westrom to include multiplying a time interval from the start of reflection to the occurrence of a signal component, indicating a fault, by one-half the rate of propagation of the reflection through the communication channel to determine the distance between one end of the communication channel and the impedance mismatch, as taught by Broding, because Broding suggests an equivalent method for calculating the distance to a location down a cable using a method that will determine the exact distance to the point of interest, which can then be used for immediate analysis, rather than determining the round trip distance to and from the point of interest (column 2, lines 48-61).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, and Westrom to include specifying that the test signal have good autocorrelation properties, as taught by Broding, because, as suggested by Broding, the combination would have allowed lower frequencies to be used in the generation signal and therefore provided less cable attenuation (column 10, lines 35-41).

8. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Amrany, Westrom and Broding, and further in view of U.S. Patent No. 5,523,758 to Harmuth.

As noted above, Liggett in combination with Amrany, Westrom, and Broding teaches many of the features of the claimed invention including generating a maximum length sequence with a plurality of taps, but does not specify that the cross-correlation be performed using a sliding tapped delay line.

Harmuth teaches a method for receiving and processing reflected radar signals (column 1, lines 6-10) using cross-correlation performed by a sliding correlator over discreet taps of a circuit-delayed line (column 3, lines 40-58). Harmuth also teaches that the input signal arriving is fed into a tapped analog delay circuit to produce a tapped delay line (column 3, lines 30-35).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, Westrom, and Broding to include specifying that the cross-correlation be performed using a sliding tapped delay line, as taught by Harmuth, because, as suggested by Harmuth, using a tapped delay line would have yielded a better approximation of the cross-correlation (column 3, lines 49-52) and, by using a sliding correlator, allowed the processing of a wider variety of pulses received by including very short pulses (column 1, lines 36-43).

9. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Amrany, Westrom, and Broding and further in view of Wong et al.

As noted above, Liggett in combination with Amrany, Westrom, and Broding teaches all of the features of the claimed invention except for adding a rotated

reflection signal to the correlated signal to reduce or remove artifacts on the correlated signal.

Wong teaches a method and apparatus for measuring the length of, or distance to discontinuities in, an optical transmission medium using optical time domain reflectometry by generating a pulse and transmitting the pulse through the optical line until a discontinuity is encountered wherein a portion of the pulse is reflected back to the measurement system (column 1, lines 37-51). Wong also teaches that by combing the reflected signal with an amplitude ripple generated due to the rotation of the incident and reflected optical signals (column 9, lines 21-50) the result can then be used to mathematically remove undesirable reflection (i.e. artifacts) from the desired response by gating components of the ripple pattern generated as the result of the rotation (column 11, lines 1-6).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, Westrom, and Broding to include adding a rotated reflection signal to the correlated signal to reduce or remove artifacts on the correlated signal, as taught by Wong, because, as suggested by Wong, the combination would have provided a method for removing undesired artifacts and computing the propagation delay, as well as provided a method for determining multiple events attributable to different discontinuities in the channel (column 2, lines 46-54 and column 3, lines 3-12).

10. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett

in view of Amrany and Westrom and further in view of U.S. Patent No. 4,041,381 to Hwa.

As noted above, the invention of Liggett, Amrany, and Westrom teaches all the features of the claimed invention except for specifying that the method be performed by an integrated circuit.

Hwa teaches methods and equipment for testing reflection points of transmission lines by transmitting a digital word from a maximal length sequence generator (column 2, lines 1-5) over a cable communication channel and receiving a reflection signal to indicate the occurrence of an impedance mismatch (column 1, lines 6-12). Hwa also teaches implementing the method using circuitry located on an integrated circuit (column 6, lines 40-49).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, and Westrom to include specifying that the method be performed by an integrated circuit, as taught by Hwa, because as suggested by Hwa the combination would have provided a device that could be manufactured cheaply and compactly so as to be used in a plurality of digital equipment (column 6, lines 40-49).

11. Claims 42 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Amrany and Westrom, and further in view of U.S. Patent No. 5,523,758 to Harmuth.

As noted above, Liggett in combination with Amrany and Westrom teaches many of the features of the claimed invention including generating a maximum length sequence with a plurality of taps, but does not specify that the cross-correlation be performed using a sliding tapped delay line or that the sequence generator or correlator comprise a tapped delay line.

Harmuth teaches a method for receiving and processing reflected radar signals (column 1, lines 6-10) using cross-correlation performed by a sliding correlator over discreet taps of a circuit-delayed line (column 3, lines 40-58). Harmuth also teaches that the input signal arriving is fed into a tapped analog delay circuit to produce a tapped delay line (column 3, lines 30-35).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany and Westrom to include specifying that the cross-correlation be performed using a sliding tapped delay line and that the sequence generator and correlator comprise a tapped delay line, as taught by Harmuth, because, as suggested by Harmuth, using a tapped delay line would have yielded a better approximation of the cross-correlation (column 3, lines 49-52) and, by using a sliding correlator, allowed the processing of a wider variety of pulses received by including very short pulses (column 1, lines 36-43).

Although Harmuth doesn't specifically disclose that the sequence generator comprises a tapped delay line, since Liggett discloses taps in the sequence generated and Harmuth teaches that the input line be a tapped delay line to provide more accurate cross-correlation, it would have been obvious to one having ordinary skill

skill in the art to include these aspects in the sequence generator conform with the line connecting the remaining components.

12. Claims 45, 46, 48 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Amrany and Westrom and further in view of U.S. Patent No. 6,075,628 to Fisher et al.

As noted above, Liggett in combination with Amrany and Westrom teaches all the features of the claimed invention except for including a scrambler in the sequence generator.

Fisher teaches a method for determining fault locations in communication systems using time domain reflectometry (column 1, lines 4-6) wherein the sequence generator includes a data scrambler (column 2, lines 64-65) and a controller for controlling an optical transmitter sending the sequence (column 2, lines 37-40 and Figure 1).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, and Westrom to include a scrambler in the sequence generator, as taught by Fisher, because, as suggested by Fisher, the combination would have scrambled the data such that the downstream transmitted data sequence has statistical properties equivalent to those of a continuous random binary sequence and therefore allowed the data itself to be used in the correlation process (column 2, line 64 to column 3, lines 4).

13. Claim 47 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Amrany, Westrom, and Fisher and further in view of U.S. Patent No. 6,417,672 to Chong.

As noted above, Liggett in combination with Amrany, Westrom, and Fisher teaches all the features of the claimed invention except for specifying that the peak voltage of the sequence signal be less than 18 volts.

Chong teaches a method for detecting a bridge tap using frequency domain analysis through time-domain reflectometry to determine an impedance mismatch (column 4, lines 11-20) wherein a test set provides an input signal having a voltage of 20 volts peak-to-peak (i.e. a peak voltage of 10 volts) (column 11, lines 1-14).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, Westrom, and Fisher to include specifying that the peak voltage of the sequence signal be less than 18 volts, as taught by Chong, because the invention of Liggett, Amrany, Westrom, and Fisher teaches using a relatively low voltage to reduce the probability of cross-talk and, while Liggett and Westrom are silent on this voltage, Chong provides a voltage that would meet this requirement. It also would have been obvious to one having ordinary skill in the art to apply any voltage that is small enough to meet this cross-talk elimination since the applicant fails to provide criticality to the selection of 18 volts.

14. Claims 50, 51, and 53 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Liggett in view of Amrany and Westrom and further in view of U.S. Patent No. 5,144,250 to Little and U.S. Patent No. 5,523,758 to Harmuth.

As noted above, the invention of Liggett, Amrany, and Westrom teaches many of the features of the claimed invention including obtaining a time between the start of the correlation signal and a subsequent peak caused by the echo from a line anomaly but does not teach a corresponding device for measuring this time, specifically a timer that comprises a counter configured to count the samples between the start of the signal and a subsequent peak. This combination also doesn't specifically disclose that the cross-correlation be performed using a sliding tapped delay line in the correlator during communication.

Little teaches a power amplifier time domain reflectometer, and corresponding method, comprising generating a modulated RF signal (column 2, lines 35-36), which is conducted on an output line to a plurality of system components which are to be tested for an impedance failure, and a bi-directional coupler that detects the waveform of the output RF signal and the waveform of the reflect RF signal caused by an impedance fault (column 1, lines 55-60). Little also teaches that the beginning of the output signal waveform is used to trigger a timing device which continues timing until the beginning of the reflected signal waveform is detected (column 1, line 60 to column 4) wherein the timing device comprises a counter that counts sample pulses between the start of the signal and a subsequent peak caused by the echo from the impedance failure (column 2, line 52 to column 2, line 12).

Harmuth teaches a method for receiving and processing reflected radar signals (column 1, lines 6-10) using cross-correlation performed by a sliding correlator over discreet taps of a circuit-delayed line (column 3, lines 40-58). Harmuth also teaches that the input signal arriving is fed into a tapped analog delay circuit to produce a tapped delay line (column 3, lines 30-35).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, and Westrom to include a timer that comprises a counter configured to count the samples between the start of the signal and a subsequent peak, as taught by Little, because the combination would have provided a timing device needed in the invention of Liggett, Amrany, and Westrom and, as suggested by Little, provided a simplified method for performing time domain reflectometry in the Gigahertz frequency range (column 1, lines 45-47).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, and Westrom to include specifying that the cross-correlation be performed using a sliding tapped delay line in the correlator during communication, as taught by Harmuth, because, as suggested by Harmuth, using a tapped delay line would have yielded a better approximation of the cross-correlation (column 3, lines 49-52) and, by using a sliding correlator, allowed the processing of a wider variety of pulses received by including very short pulses (column 1, lines 36-43).

15. Claim 52 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett

in view of Amrany, Westrom, Little, and Harmuth and further in view of U.S. Patent No. 6,122,652 to Jin et al.

As noted above, the Liggett in combination with Amrany, Westrom, Little, and Harmuth teaches many the features of the claimed invention including correlating a generated signal with a reflected signal and determining the position of detected peaks of the reflected waveform using a pulse detecting counter, but does not teach specifying that the peak detector comprises a comparator and a register for storing a current peak value.

Jin teaches a method for detecting a tone or any other periodical signal in a telephone system (column 1, lines 5-6) by segmenting the data signal into fixed length data samples, counting, with a counter, the data samples to prepare a data window therefrom, a peak value detector to monitor the data samples and to detect a sample having a peak value with the data window (column 2, lines 22-29), and a correlation unit (column 2, lines 48-49) wherein the peak detector comprises a comparator and memory (i.e. register) holding a current peak value (column 6, lines 29-33 and 39-46) and the correlation unit functions using a comparator and a counter (column 8, lines 18-34).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, Westrom, Little, and Harmuth to include specifying that the peak detector comprises a comparator and a register for storing a current peak value, as taught by Jin because, as suggested by Jin, the combination would have insured that any calculations made using a received peak voltage would be made

with respect to the correct value by resetting the detector with the current value after a predetermined count (column 4, lines 63-65 and column 6, lines 46-47) and allow for the determination of whether the correlated value lies with in a desired range (column 9, lines 30-39), as would be needed to discriminate between the correlated result of the received pulses, correlated with the generated sequence, and the correlated result of any extraneous noise pulses, correlated with the generated sequence, in the invention of Liggett, Amrany, Westrom, and Harmuth.

16. Claim 54 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Amrany, Westrom, Little, and Harmuth and further in view of U.S. Patent No. 6,292,539 to Eichen et al.

As noted above, Liggett in combination with Amrany, Westrom, Little, and Harmuth teaches all the features of the claimed invention except for specifying that the sequence signal does not generate disruptive cross-talk in adjacent pairs in a binder that also contains the twisted pair conductor.

Eichen teaches a method and apparatus for digital subscriber loop qualification including a digital subscriber loop with a structure including bridge taps, load coils, and a binder group (i.e. a group of twisted pairs bundled together) (column 2, lines 3-9).

Since the invention of Liggett, Amrany, Westrom, Little, and Harmuth teaches minimizing the voltage of the sequence signal to lower the possibility of cross-talk occurring across various twisted pairs (Liggett, column 5, lines 9-12) and Eichen

teaches that a group of twisted pairs bundled together makes up a binder group, it would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany, Westrom, Little, and Harmuth to include lowing the voltage of the sequence signal to further reduce the possibility of cross-talk between adjacent twisted pairs in a binder because the combination would have prevented unwanted interference in a plurality of DSL environments.

17. Claim 68 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Amrany and Westrom and further in view of U.S. Patent No. 6,122,652 to Jin et al.

As noted above, Liggett in combination with Amrany, Westrom teaches many the features of the claimed invention including correlating a generated signal with a reflected signal and determining the position of detected peaks of the reflected waveform, but does not teach specifying that the correlation processing comprises a compare routine and a counter.

Jin teaches a method for detecting a tone or any other periodical signal in a telephone system (column 1, lines 5-6) by segmenting the data signal into fixed length data samples, counting, with a counter, the data samples to prepare a data window therefrom, a peak value detector to monitor the data samples and to detect a sample having a peak value with the data window (column 2, lines 22-29), and a correlation unit (column 2, lines 48-49) wherein the peak detector comprises a comparator and memory (i.e. register) holding a current peak value (column 6, lines

29-33 and 39-46) and the correlation unit functions using a comparator and a counter (column 8, lines 18-34).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Amrany and Westrom to include specifying correlation processing comprises a compare routine and a counter, as taught by Jin, because, as suggested by Jin, the combination would have insured that any calculations made using a received peak voltage would be made with respect to the correct value by resetting the detector with the current value after a predetermined count (column 4, lines 63-65 and column 6, lines 46-47) and allow for the determination of whether the correlated value lies with in a desired range (column 9, lines 30-39), as would be needed to discriminate between the correlated result of the received pulses, correlated with the generated sequence, and the correlated result of any extraneous noise pulses, correlated with the generated sequence, in the invention of Liggett, Amrany and Westrom.

Response to Arguments

18. Applicant's arguments with respect to claims 1-13, 21-30, 40-54, and 60-70 have been considered but are moot in view of the new ground(s) of rejection.

Several arguments, however, are noted:

Applicant argues that the "Westrom reference is directed to testing high-voltage underground power cables utilizing a high power pulse. The claims as amended are directed to a communication device capable of achieving data communication. . .

Hence, one of ordinary skill in the art would be a designer of high-speed communication devices. As such, the Applicants assert that the Westrom reference is improperly cited by the Examiner, since one of ordinary skill in the art for high-speed data communication devices would not be aware of or familiar with high-voltage underground power line technology." The Examiner asserts that while the invention of Westrom is drawn to underground power cables, it is also more generally drawn to an overall method for performing time-domain reflectometry. Since the invention of Liggett is also concerned with a problem for performing time-domain reflectometry and further, since the invention of Westrom is included to teach processing details that could be applied in the invention of Liggett, the two inventions are properly combined.

Applicant then argues that the Westrom reference teaches away from the claimed combination "by suggesting use of a high power pulse generated by the high power pulse generator 28 shown in Figure 1. Use of a high power pulse is teaching directly opposite to the direction of the claimed invention, which utilizes a sequence of lower power pulses. Use of a high power pulse can significantly disrupt operation of adjacent lines and is limited in accuracy." As mentioned above, the invention of Westrom is not included to teach the type of pulse to be applied in the invention, but instead is included to teach processing details applicable in the invention of Liggett.

Applicant argues that the Belge reference teaches away form the claimed invention by admitting that "analyzing the time domain waveform of the echo signal

becomes very complicated. For this reason, a model based approach can be used for the TDR estimations." The Examiner contends that in the current Office Action, the invention of Belge is not used to teach that a modem is implemented to perform the time-domain reflectometry but instead is included to teach the equivalency between bridged taps and impedance mismatches and the detection of an impedance mismatch caused by a load coil. Further, since the cited portions of Belge suggest that the use of a modem to carry out time-domain reflectometry would be desirable, the reference as a whole does not teach away from the claimed invention.

Applicant then argues that the "Broding reference is directed to a method and apparatus for determining the length of a logging cable introduced into a bore hole, i.e., well hole. This reference is in no way related to TDR on a high speed communication channel. As supported by the Declaration, when those of skill in the art of high speed communication systems look to art, they do not look to reference directed to either logging cable or oil or gas wells." Similar to the position regarding the inclusion of the Westrom reference, the Examiner maintains that invention of Broding is concerned with the problem of time-domain reflectometry and is only included to teach processing details that would be applicable in the invention of Liggett.

Applicant then indicated that claims 26 and 60 have been amended to include features not contained within the cited art. "Claim 26 now requires the sequence signal to have [auto]-correlation properties. Claim 60 now requires that the means

for correlating comprise means for cross correlating." As stated in the previous Office Action, the invention of Broding teaches specifying that the input signal has good auto-correlation properties and the invention of Liggett includes a cross-correlating means. Further, as shown by the definition of auto-correlation, any signal that can be integrated has some auto-correlation properties.

Conclusion

19. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

U.S. Patent No. 6,177,801 to Chong teaches the detection of bridge taps using time domain reflectometry in a modem communication device.

U.S. Patent No. 5,745,549 to Botto et al. teaches a line break detection device and modem comprising such a device.

Wolfram Research, "Eric Weisstein's World of Mathematics: Cross-Correlation" teaches the relationship between cross-correlation and convolution.

Wolfram Research, "Eric Weisstein's World of Mathematics: Autocorrelation" teaches how to determine the auto-correlation properties of any signal.

20. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey R. West whose telephone number is (703)308-1309. The examiner can normally be reached on Monday through Friday, 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marc S. Hoff can be reached on (703)308-1677. The fax phone numbers for the organization where this application or proceeding is assigned are (703)308-7382 for regular communications and (703)308-7382 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

jrw
June 10, 2003

MARC S. HOFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800